SECTION 10.0

# Engineering

## 10.1 Introduction

In accordance with CEC regulations, this section, together with the engineering appendices and Sections 6.0 and 7.0 (Gas Supply and Water Supply, respectively), presents information concerning the design and engineering of the Turlock Irrigation District (TID) Walnut Energy Center (WEC). Subsection 10.2 describes the design of the facility with reference to Section 2.0, Project Description. Subsection 10.3 discusses the reliability of the WEC. Subsection 10.4 presents the estimated thermal efficiency of the facility. Subsection 10.5 describes the laws, ordinances, regulations, and standards (LORS) applicable to the engineering of the WEC and identifies agencies that have jurisdiction and the contact persons within those agencies.

## 10.2 Facility Design

A detailed description of the WEC project is provided in Subsection 2.2, Generating Facility Description, Design, and Operation. Design for safety is provided in Subsection 2.3, Facility Safety Design.

Appendix 10G includes a geotechnical report for the project anticipating soil conditions based on a previous geotechnical study performed for a nearby parcel. A detailed geotechnical assessment of the proposed site has not been performed. Preliminary geotechnical investigations specific to the project site are scheduled to be performed during the fourth quarter of 2002. The resulting report will be provided to the CEC when it becomes available.

Summary descriptions of the design criteria are included in the following appendices:

- Appendix 10A, Civil Engineering Design Criteria
- Appendix 10B, Structural Engineering Design Criteria
- Appendix 10C, Mechanical Engineering Design Criteria
- Appendix 10D, Electrical Engineering Design Criteria
- Appendix 10E, Control Engineering Design Criteria
- Appendix 10F, Chemical Engineering Design Criteria
- Appendix 10G, Geologic and Foundation Design Criteria

Design and engineering information and data for the following systems are found in the following sections of this AFC:

- **Power Generation**—See Subsection 2.2.4, Combustion Turbine Generators (CTGs), Heat Recovery Steam Generators (HRSGs), Steam Turbine Generator (STG), and Condenser. Also see Appendix 10C and Subsections 2.2.5 through 2.2.9, which describe the various plant auxiliaries.
- **Heat Dissipation**—See Subsection 2.2.8, Plant Cooling Systems, and Appendix 10C.

- **Cooling Water Supply System**—See Subsection 2.2.7, Water Supply and Use; Subsection 2.2.7.4.1, Water for the Circulating Water System; and Appendix 10F.
- **Air Emission Control System**—See Subsection 2.2.11, Emission Control and Monitoring, and Subsection 8.1, Air Quality.
- **Waste Disposal System**—See Subsection 2.2.9 and Subsection 8.13, Waste Management.
- **Noise Abatement System**—See Subsection 8.5, Noise.
- **Switchyards/Transformer Systems**—See Subsection 2.2.5, Major Electrical Equipment and Systems; Subsection 2.2.13.2, Grounding; Subsection 2.2.5.1, AC Power-Transmission; Subsection 2.2.14, Interconnect to Electrical Grid; Section 5.0, Electric Transmission; and Appendix 10D.

# 10.3 Facility Reliability

This section discusses the availability of fuel, and the expected service life of the plant and the degree of reliability to be achieved by the WEC.

## 10.3.1 Fuel Availability

Natural gas will be purchased from numerous gas suppliers and delivered to the WEC by Pacific Gas & Electric Company (PG&E). PG&E is the major transporter of natural gas in northern California, delivering gas from both Canada and the southwest United States to customers on its system. Purchases of natural gas may be aggregated into a common portfolio and delivered on PG&E's transmission system to a delivery point at the interconnection of PG&E's transmission system and the physical supply line to the WEC. The supply line will commence at PG&E's Line 215 located approximately 3.6 miles south of the WEC and terminate at the WEC (see Section 6.0). It is conceivable that PG&E's line or the line from the PG&E interconnect point to the WEC could become temporarily inoperable due to a breach in the lines or from other causes, resulting in fuel being unavailable at the WEC. The WEC has no backup supply of natural gas or other fuel and would, therefore, have to be shut down until the situation was corrected.

## 10.3.2 Plant Availability

The WEC will be operated as an integral part of TID's overall generation system and will be economically dispatched by TID depending on system demand, generating cost, availability of other generating units, and other factors. Due to the relatively high efficiency of the WEC in TID's generating system, it is anticipated that for normal operations, the facility will operate at high average annual capacity. The WEC will be designed to operate between approximately 25 and 100 percent of base load to support dispatch service. The WEC will be designed for an operating life of 30 years. Reliability and availability projections are based on this operating life. Operation and maintenance procedures will be consistent with industry standard practices to maintain the useful life status of plant components.

The WEC combined-cycle power block will consist of two natural-gas-fired CTGs, two HRSGs, and one STG (two-on-one combined-cycle configuration).

The WEC is projected to operate between 50 and 100 percent of the time during each of the 30 years. The percent of time that the WEC is projected to operate is defined as the "service factor." The service factor considers the amount of time that a unit is operating and generating power, whether at full or partial load. The projected service factor for the WEC, which considers projected percentage of time of operation, differs from the equivalent availability factor (EAF), which considers the projected percentage of energy production capacity achievable. EAF is defined as a weighted average of the percentage of full energy production capacity achievable. The projected EAF for the WEC is estimated to be in the range of 92 to 98 percent. EAF differs from the "availability of a unit," which is the percentage of time that a unit is available for operation, whether at full load, partial load, or standby.

The WEC project will use up to 1,800 acre feet per year (afy) of recycled water provided by the City of Turlock's Wastewater Treatment Plant (WWTP) for cooling tower make-up. Cooling water will be cycled in the cooling tower approximately three and a half times. The blowdown will be concentrated and the water recycled onsite using a zero-liquid-discharge (ZLD) system (see Subsection 2.2.9.1.2). The ZLD system will provide makeup water to the steam cycle demineralized water system.

The recycled water will be delivered via a new 1.6-mile pipeline from the WWTP to the project site. The City is currently developing a Title 22 water treatment facility and is required by the Regional Water Quality Control Board (RWQCB) to have it operational by May 2006. Since the WEC project will commence operations the fourth quarter of 2005, TID proposes to use potable water from the City of Turlock to meet the WEC's water demands until the City's recycled water is available. The potable water will be provided via a new 0.9-mile pipeline connecting to an existing City water main located in Tegner Road, east of WEC site. Potable water for drinking, safety showers, fire protection water, service water, and sanitary uses will continue to be served from the City's potable water system. Sanitary wastewater disposal will be to an onsite septic system and leach field.

Solid waste will be collected by the local non-hazardous waste collector. Most hazardous wastes will be collected and recycled by permitted recycling firms, and non-recyclable hazardous wastes will be collected by a licensed hazardous waste hauler and deposited in a hazardous waste landfill. For detailed information on the use of hazardous materials and management of wastes, see Subsections 8.12 and 8.13.

There are no known geologic hazards other than the remote possibility of a major earthquake (see Subsection 8.15).

Special design features are included in the WEC design to ensure power plant reliability, including redundancy of critical components (see Subsection 2.4.2, Redundancy of Critical Components).

Deterioration of output capacity and efficiency of the WEC over time, called degradation, is expected to be on the order of 2 to 3 percent over a 3-year period. Cleaning, maintenance, or overhaul will recapture most of the loss. Over the expected 30-year life of the facility, the estimated total, nonrecovered loss in output and efficiency will be on the order of 1 to 2 percent.

# 10.4 Thermal Efficiency

The maximum thermal efficiency that can be expected from a natural-gas-fired combined-cycle plant using GE 7EA combustion turbine units is approximately 42 to 46 percent on a higher heating value (HHV) basis. This level of efficiency is achieved when a facility is base-loaded. The WEC is estimated to have a thermal efficiency of 45 percent (HHV) at base load and annual average ambient conditions. Other types of operations, particularly those at less than full gas turbine output, will result in lower efficiencies. The basis of the WEC operations will be system dispatch within TID's power generation and delivery system. Although it is expected the WEC will be primarily operated as a base load unit, especially during summer months, there may be periods when the WEC will be operated in load following or cycling service. The number of startup and shutdown cycles is expected to range between zero and 300 per year per CTG.

Plant fuel consumption will depend on the operating profile of the power plant. It is estimated that the range of fuel consumed by the power plant will be from a minimum of near zero British thermal units (Btu) per hour to a maximum of approximately 2,100 million Btu per hour (higher heating value basis) at base load and minimum ambient conditions.

There will be essentially no fuel gas consumption when the facility is shut down.

The net annual electrical production of the WEC cannot be accurately forecast at the present time due to uncertainties in TID's system load dispatching model. The maximum annual generation possible from the facility is estimated to be approximately 2,300 gigawatt hours (GWh) per year. The amount of startup and shutdown power generation can also only be estimated.

The number of hours that the WEC will be operated at a various load points will depend ultimately on TID's system demand and hydroelectric power availability.

# 10.5 Laws, Ordinances, Regulations, and Standards (LORS)

## 10.5.1 General LORS

The following LORS are generally applicable to the project:

- Uniform Fire Code, Article 80
- Occupational Safety and Health Act—29 CFR 1910 and 29 CFR 1926
- Environmental Protection Agency—40 CFR 60, 40 CFR 75, 40 CFR 112, 40 CFR 302, 40 CFR 423, 40 CFR 50, 40 CFR 100, 40 CFR 260, 40 CFR 300, and 40 CFR 400
- California Code of Regulations—Title 8, Sections 450 and 750 and Title 24, 1995, Titles 14, 17, 19, 20, 22, 23, and 26
- California Department of Transportation—Standard Specifications
- California Occupational Safety and Health Administration—Regulations and Standards
- California Business and Professions Code—Sections 6704, 6730, and 6736
- California Vehicle Code—Section 35780

- California Labor Code—Section 6500
- Federal Aviation Agency—Obstruction Marking and Lighting AC No. 70/7460-1H
- Stanislaus County—Regulations and Ordinances
- City of Turlock—Regulations and Ordinances

Codes and standards pertinent to the generating facility are presented in Engineering Appendices 10A through 10F. The applicable local LORS and local agency contacts involved in administration and enforcement are described below.

### 10.5.2 Local LORS

The WEC site zoning is consistent with the development of a generating facility (see Subsection 8.4, Land Use).

The WEC site is located within the city limits of the City of Turlock, in an area zoned for industrial use, and will therefore be subject to all applicable regulations of the City of Turlock.

## 10.6 Local Agency Contacts

Table 10.5-1 lists local agency contacts.

**TABLE 10.5-1**
Local Agency Contacts

| Agency | Contact | Title | Telephone |
|---|---|---|---|
| City of Turlock Fire Services | Jerry McDaniel | Fire Marshall | (209) 668-5580 |
| City of Turlock | Steven Kyte | City Manager | (209) 668-5540 |
| Stanislaus County Environmental Health Department | Jim Simpson | Hazardous Materials Program Manager | (209) 525-6753 |

## 10.7 Local Permits Required and Permit Schedule

After the receipt of the approval of project design, several permits will be required. These include a Building Permit, a Grading Permit, and a Certificate of Occupancy. These three permits are described in the City of Turlock's Municipal Ordinance.